MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

BEC2054 –ECONOMETRICS 2

(All sections / Groups)

8 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **FOUR (4)** questions in **SIX (6)** printed pages, including formula sheet and statistical tables.

2. Answer **ALL** questions in the answer booklet provided.

3. Marks are shown at the end of each question.

Question 1

(a) Illustrate the *order condition of identification* in a model of M simultaneous equations. (8 marks)

(b) Consider the following demand-and-supply model for money:

Demand for money: $M_t^a = \beta_0 + \beta_1 Y_t + \beta_2 P_t + \beta_3 Y_{t-1} + \mu_{1t}$ ... (1.1)

Supply of money: $M_t^s = \alpha_0 + \alpha_1 Y_t + \mu_{2t}$ ... (1.2)

where M = money
Y = income
P = price

Assume that P and Y_{t-1} are predetermined, and M and Y are endogenous.

(i) By the *order condition*, assess if the demand function is identified. (3 marks)

(ii) By the *order condition*, assess if the supply function is identified. (3 marks)

(iii) Interpret which method you would use to estimate the parameters of the identified equation(s). (4 marks)

(iv) Suppose you modify the supply function by adding the explanatory variable M_{t-1}. Assess if you would still use the method you used in (iii). (7 marks)

[Total: 25 marks]

Continued...

Question 2

(a) Interpret the following terms:

(i) Integrated time series (3 marks)

(ii) A unit root (3 marks)

(iii) Cointegration (3 marks)

(b) Given a total of 80 quarterly observations, which covers the period from 2002 Q1 to 2021 Q4, on M2 money supply and GNP, consider the following simple model:

$$LM2_t = -10.3571 + 2.5975LGNP_t \quad \ldots (2.1)$$
$$t \quad = (\text{-}10.9422) \quad (28.8865)$$

R-squared = 0.9953 Durbin-Watson $d = 0.1155$

Where $LM2$ = M2 money supply (in logarithmic form)
$LGNP$ = gross national product (in logarithmic form)

(i) Assess the regression (2.1). (3 marks)

(ii) The Augmented Dickey-Fuller tests with a constant and a trend are shown below:

$$\Delta\hat{LM2}_t = -0.079LM2_{t-1} + 0.0084 + 0.052t + 0.7430\Delta LM2_{t-1} \quad \ldots (2.2)$$
$$\tau \quad = (\text{-}2.963) \qquad (3.945) \quad (3.744) \quad (10.326)$$

$$\Delta\hat{LGNP}_t = -0.175LGNP_{t-1} + 0.0363 + 0.002t + 0.2851\Delta LGNP_{t-1} \quad \ldots (2.3)$$
$$\tau \quad = (\text{-}3.052) \qquad (5.516) \quad (2.275) \quad (2.980)$$

At α = 5%, assess the hypotheses whether there are unit roots in these two-time series above. (8 marks)

(iii) Based on the Engle-Granger procedure, when we performed a unit root test on the residuals obtained from the regression (2.1), we attained the following result:

$$\Delta\hat{u}_t = -0.181\hat{u}_{t-1} \quad \ldots (2.4)$$
$$\tau \quad = (\text{-}3.636)$$

Assess if the variables of $LM2$ and $LGNP$ are cointegrated or spuriously related at $\alpha = 5\%$. (5 marks)

[Total: 25 marks]

Continued...

Question 3

(a) Suppose that given the data on log GDP (Gross Domestic Product), you want to fit a suitable ARIMA model for a short-term forecast on these data. Sketch the **FOUR (4)** steps involved in carrying out this task. (12 marks)

(b) Interpret the meaning of ARIMA (4, 2, 1). (3 marks)

(c) The Eviews output below exhibits the Koyck model, examining relationship between consumption expenditure (CONS) and disposable income (DI) for Country XYZ for the period 1973 – 2020.

Dependent Variable: CONS
Method: Least Squares
Sample (adjusted): 2 48
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-92.1841	57.3517	-1.607348	0.1151
DI	0.414890	0.070617	5.875214	0.0000
CONS (-1)	0.567240	0.061362	9.244158	0.0000

R-squared	0.988216	Mean dependent var	16691.28
Adjusted R-squared	0.988134	S.D. dependent var	5205.873
S.E. of regression	220.8604	Akaike info criterion	13.73045
Sum squared resid	218.4539	Schwarz criterion	13.84854
Log likelihood	-319.6656	Hannan-Quinn criter.	13.77489
F-statistic	12306.99	Durbin-Watson stat	0.961921
Prob(F-statistic)	0.000000		

(i) Interpret the short-run marginal propensity to consume (MPC). (4 marks)

(ii) Compute the long-run MPC and interpret it. (6 marks)

[Total marks: 25 marks]

Continued...

Question 4

(a) Show the difference between dynamic model and distributed-lag model. (5 marks)

(b) Interpret the following terms:

(i) Volatility clustering (3 marks)

(ii) Leptokurtosis (3 marks)

(c) Provide an explanation for why GARCH is considered superior to ARCH. (4 marks)

(d) The following ARCH models are based on the CPI (Consumer Price Index) data for Country XYZ from January 1967 to February 2020, for a total of 649 monthly observations.

ARCH (1) Model: $\hat{u}_t^2 = 0.000088 + 0.3839\hat{u}_{t-1}^2$ ... (4.1)

t = (7.684) (12.235)

$R^2 = 0.2497$ $d = 1.969$

ARCH (2) Model: $\hat{u}_t^2 = 0.000038 + 0.1412\hat{u}_{t-1}^2 + 0.0971\hat{u}_{t-2}^2$ ... (4.2)

t = (6.42) (3.37) (3.01)

$R^2 = 0.3253$ $d = 2.0114$

Illustrate how you would choose between the two models at α = 5%. Show the necessary calculations by using F test. (10 marks)

[Total: 25 marks]

End of Questions

Formula

$$F = \frac{(R^2_{UR} - R^2_R)/m}{(1 - R^2_{UR})/(n-k)};$$

n = number of observations; m = number of linear restrictions; k = number of parameters in the unrestricted (UR) regression

Statistical Tables

Appendix A: t-Table

two tails	0.2	0.1	0.05	0.02	0.01
One tail	0.1	0.05	0.025	0.01	0.005
df					
10	1.37	1.81	2.23	2.76	3.17
20	1.33	1.72	2.09	2.53	2.84
30	1.31	1.70	2.04	2.46	2.75
40	1.30	1.68	2.02	2.42	2.70
50	1.30	1.68	2.01	2.40	2.68
60	1.30	1.67	2.00	2.39	2.66
75	1.29	1.67	1.99	2.38	2.64
100	1.29	1.66	1.98	2.36	2.63
120	1.29	1.66	1.98	2.36	2.62

Appendix B: F-table (α=0.05)

df2\df1	1	2	3	4	5	6	7	8
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18
50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10
70	3.98	3.13	2.74	2.50	2.35	2.23	2.14	2.07
80	3.96	3.11	2.72	2.49	2.33	2.21	2.13	2.06
100	3.94	3.09	2.7	2.46	2.31	2.19	2.10	2.03
200	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98
500	3.86	3.01	2.62	2.39	2.23	2.12	2.03	1.96
1000	3.85	3.00	2.61	2.38	2.22	2.11	2.02	1.95

Appendix C

TABLE D.7 1% AND 5% CRITICAL DICKEY–FULLER t ($= \tau$) AND F VALUES FOR UNIT ROOT TESTS

Sample size	t_{nc}*		t_c*		t_{ct}*		F†		F‡	
	1%	5%	1%	5%	1%	5%	1%	5%	1%	5%
25	−2.66	−1.95	−3.75	−3.00	−4.38	−3.60	10.61	7.24	8.21	5.68
50	−2.62	−1.95	−3.58	−2.93	−4.15	−3.50	9.31	6.73	7.02	5.13
100	−2.60	−1.95	−3.51	−2.89	−4.04	−3.45	8.73	6.49	6.50	4.88
250	−2.58	−1.95	−3.46	−2.88	−3.99	−3.43	8.43	6.34	6.22	4.75
500	−2.58	−1.95	−3.44	−2.87	−3.98	−3.42	8.34	6.30	6.15	4.71
∞	−2.58	−1.95	−3.43	−2.86	−3.96	−3.41	8.27	6.25	6.09	4.68

*Subscripts nc, c, and ct denote, respectively, that there is no constant, a constant, and a constant and trend term in the regression (21.9.5).

†The critical F values are for the joint hypothesis that the constant and δ terms in (21.9.5) are simultaneously equal to zero.

‡The critical F values are for the joint hypothesis that the constant, trend, and δ terms in (21.9.5) are simultaneously equal to zero.

Source: Adapted from W. A. Fuller, *Introduction to Statistical Time Series,* John Wiley & Sons, New York, 1976, p. 373 (for the τ test), and D.A. Dickey and W. A. Fuller, "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica,* vol. 49, 1981, p. 1063.

End of Paper